

**DEVELOPMENT OF VIRTUAL ROBOT ASSISTED  
LEARNING (VRAL) IN ROBOTIC COURSE USING  
VIRTUAL ENVIRONMENT TECHNIQUE**

**NORAINA BINTI MOHAMAD**

**UNIVERSITI UTARA MALAYSIA  
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**DEVELOPMENT OF VIRTUAL ROBOT ASSISTED  
LEARNING (VRAL) IN ROBOTIC COURSE USING  
VIRTUAL ENVIRONMENT TECHNIQUE**

**This dissertation is submitted to the Centre for Graduate Studies**

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**By**

**Noraina binti Mohamad**



**JABATAN HAL EHWAL AKADEMIK  
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## **ABSTRAK**

Realiti Maya, perkembangan terbaru dalam bidang reka bentuk antara muka dan grafik komputer interaktif, menawarkan kebaikan kepada kaedah klasik pengajaran dan pembelajaran. Beberapa modul pendidikan berasaskan Realiti Maya telah dilakukan untuk mengkaji kebaikannya. Penyelidikan ini berusaha untuk menawarkan sumber alternatif kepada pelajar yang tidak dapat menggarap pembelajaran di dalam kelas dan buku teks sepenuhnya dengan menggunakan teknologi Realiti Maya. Objektif utamanya ialah memberikan pelajar satu kaedah baru yang akan memberikan kefahaman yang lebih mendalam kepada pembelajaran yang sebelum ini dipersembahkan dalam bentuk tradisional.

Cara yang terbaik untuk mengajar robotik ialah setiap pelajar dapat mengawal robot masing-masing. Tetapi, kos untuk menyediakan setiap pelajar satu robot adalah terlalu mahal. Dengan sistem robot maya, pelajar akan dapat pengalaman secara terus pengendalian robot secara maya. Dalam penyelidikan ini, satu prototaip robot maya dibina untuk membantu pembelajaran kursus robotik. Prototaip ini kemudiannya diuji oleh pelajar Diploma Kejuruteraan Mekanikal, Politeknik Sultan Abdul Halim Muzaffar Syah (POLIMAS) untuk mendapatkan maklumat awal mengenai kebaikan dan kelemahan prototaip ini. Ciri-ciri yang diuji adalah: interaksi, kebolehpercayaan, ergonomik, kebebasan menjelajah, keselamatan, pembelajaran dan robotik. Keputusan menunjukkan bahawa prototaip ini berpotensi untuk membantu pembelajaran robotik kerana pelajar bersetuju dengan kebaikan yang ditawarkan oleh prototaip ini.

## **ABSTRACT**

Virtual Reality (VR), the recent development in the fields of user interface design and interactive computer graphics, offers significant advantages to classical methods of teaching and learning. A series of VR based educational modules are being developed to explore the capabilities. This research aims to offer an alternative resource for those students who did not fully grasp the material in class or from the text by utilizing VR technology. Its main objective is to provide these students with another viewpoint that will give them a better understanding to the material that was previously presented through traditional means.

The best way to learn robotics is that each persons control his/her own robot. But the cost of providing a robot for each student is too expensive. With the virtual robot system, students can have hands-on experience virtually. In this research, a virtual robot prototype was developed to assist robotics course teaching. It was then evaluated by the students from Mechanical Engineering Diploma, Politeknik Sultan Abdul Halim Muzaffar Syah (POLIMAS) students to get initial insights of the prototype benefits and limitations. The features being tested were: interaction, believability, ergonomics, freedom to explore, safety, learning and robotics. The result shows that the prototype has a potential in assisting robotics learning as the students agreed to the benefits that the prototype could offer.

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# LIST OF CONTENTS

	Page
<b>PERMISSION TO USE.....</b>	<b>ii</b>
<b>ABSTRAK.....</b>	<b>iii</b>
<b>ABSTRACT.....</b>	<b>iv</b>
<b>ACKNOWLEDGEMENTS.....</b>	<b>v</b>
<b>LIST OF CONTENTS.....</b>	<b>vi</b>
<b>LIST OF TABLES.....</b>	<b>x</b>
<b>LIST OF FIGURES.....</b>	<b>xi</b>
<b>LIST OF ABBREVIATIONS.....</b>	<b>xiv</b>
 <b>CHAPTER 1 INTRODUCTION</b>	
1.1 Motivation.....	1
1.2 Problem Statement.....	3
1.3 Research Question.....	4
1.4 Research Objective.....	4
1.5 Proposed Solution.....	4
1.6 Scope Of The Research.....	6
1.7 Thesis Organization.....	6
 <b>CHAPTER 2 LITERATURE REVIEW</b>	
2.1 Virtual Reality.....	8
2.1.1 Definitions.....	8
2.1.2 Historical Background of VR System.....	9
2.1.3 Types Of VR System.....	10



2.1.4 VR Applications.....	13
2.2 Robotics.....	18
2.2.1 Virtual Robot: Related Research.....	21
2.2.2 Teaching In Robotics.....	27
2.3 Benefits of VR Features.....	27
2.3.1 Interaction Paradigm.....	28
2.3.2 Value To Engineering.....	29
2.3.3 Real-time Applicability.....	31
2.4 VR Authoring.....	31
2.4.1 Generic Model Of An Educational Virtual Environment.....	32
2.4.2 Key Steps In Creating Virtual Environments.....	33
2.4.3 Modeling Tools.....	34
2.4.4 VR Tools.....	35
2.4.5 Hardware Requirements.....	37
2.5 Usability.....	37
2.5.1 Selected Criteria for Assessing Satisfaction.....	38
2.6 Conclusion.....	43

## CHAPTER 3 METHODOLOGY

3.1 Literature Review.....	45
3.2 Prototype.....	46
3.2.1 Requirements Gathering.....	46
3.2.2 Prototype Design.....	48
3.2.3 Prototype Development.....	50
3.3 Testing.....	52
3.3.1 Usability Assessment.....	52
3.3.2 Pilot Study.....	53
3.4 Analysis.....	53
3.4.1 Validity and Reliability.....	54
3.5 Conclusion.....	56

## CHAPTER 4 VRAL IMPLEMENTATION

4.1 3D Modeling.....	57
4.1.1 Available Building Methods.....	58

4.1.2 3D Editing.....	58
4.1.3 Lighting/Texture Mapping/Camera.....	59
4.1.4 Shapes Developed.....	59
4.2 Animation.....	68
4.2.1 Pick And Place.....	70
4.2.2 Optimization In Animation.....	74
4.3 Real-time Interactivity In Cosmo World 2.0.....	74
4.4 Interface.....	78
4.5 Data Exchange/Translation Issues.....	79
4.6 Comparison Of VRAL And Related Virtual Robot.....	81
4.7 Conclusion.....	83

## CHAPTER 5 RESULTS AND ANALYSIS

5.1 Results.....	84
5.1.1 Demographic.....	85
5.1.2 Problems With Existing Learning Process.....	86
5.1.3 Experience Of Being Involved In The Demonstration.....	88
5.1.4 Perceptions Towards VR Technology.....	90
5.1.5 Perceptions Towards VRAL.....	91
5.1.6 Perceptions In The Learning Process.....	92
5.1.7 Suggestions In Improving The Prototype .....	93
5.2 Results from Lecturers.....	94
5.2.1. Perceptions Towards VR Technology.....	95
5.2.2 Perceptions Towards VRAL.....	96
5.2.3 Perceptions In The Learning Process.....	97
5.2.4 Suggestions In Improving The Prototype .....	98
5.3 Inferential Analysis.....	99
5.3.1 Hypothesis Test.....	99
5.3.2 Correlation and Strengthen Test.....	102
5.4 Discussion.....	104
5.5 Conclusion.....	104

## **CHAPTER 6 CONCLUSION**

6.1 Summary Of Important Findings.....	106
6.2 Conclusion.....	107
6.3 Limitations.....	108
6.4 Suggestions/Identification For Further Research .....	109

<b>REFERENCES.....</b>	<b>111</b>
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## **APPENDICES**

<b>APPENDIX A: Introduction To Robotics Module.....</b>	<b>118</b>
<b>APPENDIX B: Story Board.....</b>	<b>121</b>
<b>APPENDIX C: Questionnaire.....</b>	<b>122</b>
<b>APPENDIX D: VRML Scripting.....</b>	<b>130</b>
<b>APPENDIX E: User Manual.....</b>	<b>131</b>
<b>VITAE.....</b>	<b>134</b>

## LIST OF TABLES

<b>Table</b>	<b>Title</b>	<b>Page Number</b>
2.1	Summary Of Virtual Robot With Tasks And Movement	24
2.2	VR Features Applied In Each Virtual Robot	25
2.3	Common User Input Tasks	26
2.4	Overview Of 3D Modelers	34
2.5	Overview Of VRML Editors	36
2.6	Overview Of VRML Players	36
3.1	The Tasks Of Robotics Proposed To Be Implemented In VE	48
4.1	Movement For Joint	71
4.2	Movement For First Link	71
4.3	Gripper Tasks	72
4.4	Movement For Second Link	73
4.5	Min And Max Angle For Each Link	77
4.6	Comparison Of VRAL To Related Virtual Robot	82
4.7	Comparison With Added Feature To VRAL	83
5.1	Descriptive Analysis Towards Problem In Existing Learning Process	87
5.2	Descriptive Analysis On Perceptions Towards VR Technology	90
5.3	Descriptive Analysis On Perceptions Towards VRAL	91
5.4	Descriptive Analysis On Perceptions Towards Learning Process	92
5.5	Descriptive Analysis For Limitation In The Prototype	93
5.6	Descriptive Analyses For Suggestion To Improve The Prototype	94
5.7	Descriptive Analysis On Perceptions Towards VR Technology	95
5.8	Descriptive Analysis On Perceptions Towards VRAL	96
5.9	Descriptive Analysis On Perceptions Towards Learning Process	97
5.10	Descriptive Analysis For Limitation In The Prototype	98
5.11	Descriptive Analyses For Suggestion To Improve The Prototype	99
5.12	Paired t-test analysis for ease of use variable	100
5.13	Paired t-test analysis for easy to understand variable	100
5.14	Paired t-test analysis for robot motion/navigation variable	101
5.15	Paired t-test analysis for learning variable	101
5.16	Paired t-test analysis for real-time interactivity/response variable	102
5.17	Hypothesis Results	102
5.18	Pearson correlation analysis on variables used in the survey	103
6.1	Questions And Answers In The Research	106

## LIST OF FIGURES

<b>Figure</b>	<b>Title</b>	<b>Page number</b>
1.1	Scope Of The Research	6
2.1	Cave System	11
2.2	Telepresence Technique	11
2.3	Fishtank Technique	12
2.4	Responsive Workbench	12
2.5	Desktop VR	13
2.6	Virtuality SU1000	15
2.7	Material Handling	18
2.8	Coating	19
2.9	Assembly	19
2.10	Welding	20
2.11	Interactive Robot Manipulation With VRML 2.0	22
2.12	Remote Manipulation of Robots	22
2.13	RoboSIM 2.0	23
2.14	Robot Programming And Simulation Using VR Techniques	23
2.15	Generic Model Of An Educational Virtual Environment	32
2.16	Steps Involved In Creating A Virtual Environment	33
3.1	Research Methodology	45
3.2	Panarobo KSV20 Robot	47
3.3	Steps In Prototype Development	50
4.1	Model of 3D Robot	60
4.2	Base	60
4.3	Standard Primitive Shapes	61
4.4	Modifiers Toolbar from More button	61
4.5	First Link	62
4.6	Taper tool From Modifier Toolbar	62
4.7	Second Link	63
4.8	Bend Tool From Modifiers With Parameters	63
4.9	Cylinder Shape Added To The Box Shape.	64
4.10	Clone Properties	64
4.11	Boolean Operation Process	65
4.12	Third Link	65
4.13	Boxes Created For Third Link	66
4.14	Fourth Link	66

4.15	Wires For The Fourth Link	67
4.16	A NURBS Point Shape With A Circle	67
4.17	Gripper	68
4.18	Animator Keyframe	68
4.19	Time Configuration Toolbar	69
4.20	Link Controller	70
4.21	Dummy	70
4.22	Animation In Progress	73
4.23	Cosmo World 2.0 Main Toolbar	74
4.24	Cosmo World 2.0 Interface	75
4.25	Outline Editor For Virtual Robot Prototype	75
4.26	Create Extras Toolbar	76
4.27	Real-time Interactivity	76
4.28	Buttons On The Cosmo Player Interface	77
4.29	Introduction Page	78
4.30	Main Page	79
4.31	Translation Process from 3D Studio Max To VRML	79
5.1	Ever Use Any VR Application	85
5.2	Type of VR Application	86
5.3	Happy To Be Involved In The Demonstration	88
5.4	Learn Robotics From the Demonstration	88
5.5	Give Additions To Lesson In Class	89

## LIST OF APPENDICES

Appendix	Title	Page number
A-1	Robotics Teaching Module (first page)	118
A-2	Robotics Teaching Module (second page)	119
A-3	Robotics Teaching Module (third page)	120
B-1	Storyboard	121
C-1	Questionnaire	122
D-1	Part Of The VRML Scripting For Virtual Robot Prototype I	130
D-2	Part Of The VRML Scripting For Virtual Robot Prototype II	130
E-1	Main Page	131
E-2	Control Panel	132
E-3	Robot Movements By Animation	133
E-4	Robot Movements By Real-time Interactivity	133

## LIST OF ABBREVIATIONS

CAD	Computer Aided Design
CAVE	CAVE Artificial Virtual Environments
CBT	Computer-based Training
HMD	Head Mounted Display
Lab	Laboratory
LOD	Level of Details
PC	Personal Computer
POLIMAS	Politeknik Sultan Abdul Halim Muadzam Shah
SUS	System Usability Scale
VAT	Value Added Tax
VE	Virtual Environment
VICHER	Virtual Chemical Reactors
VR	Virtual Reality
VRML	Virtual Reality Modeling Language
VRAL	Virtual Robot Assisted Learning
WoW	Window on World
WWW	World Wide Web
3D	3 Dimensional



## **CHAPTER 1**

### **INTRODUCTION**

Technological advancement in information and communication technology (ICT) has created paradigm shift in education. One of the many innovations in education tool is the use of Virtual Reality (VR) technology in delivering information and provides operative simulation to enrich student learning.

The strive for a competent and practical system that is dependable, safe and easy to use has always been the motivation to come out with a new application from a new technology. Although VR is being used widely, however a thorough understanding of how VR can be utilized and what affects it gives to humankind is still lacking. Motivated from this point, this research is aimed to provide a baseline in exploring the features in VR that could be applied in the areas of robotics particularly in education domain.

#### **1.1 Motivation**

Realizing the advantage of VR, effort has been taken to use VR system in robotics education. A common problem in robotics education is the limited availability of expensive robotics and control equipment which allow the students in the educational program to work, in order to acquire valuable 'hands-on' experience (Safaric et al, 2001a). In learning robotics, students are required to have valuable 'hands-on' experience to be competitive in the job market and in line with current needs of the industry. But most institutions encountered the problem with the unavailability of enough robots to facilitate robotics learning. This problem resulted from lack of exposure in operating robots and made the students weak in the basic understanding of robotics.

The contents of  
the thesis is for  
internal user  
only

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